

## Getting Started with the EyeFoss

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## Topics:

- Scope
- Alignment of Expectations
- Calibration Material
- Validation Samples

- The “target” is a future, imaginary customer with no prior knowledge of the technology but with a stated interest in testing the EyeFoss.
- The main focus shall be on the early testing stages of development.
- The recommendations shall encompass processes to be conducted by both the customer and Foss Analytical, as well as the interactive processes between these two parties.

## Alignment of Expectations:

- Commercial importance to customer.
- Grading range to be covered.
- Acceptance to work cross-company.
- Availability of biological material for development and validation.
- Easy/complicated and previous EyeFoss experience.
- Official reference methods to be observed.
- Amount of work expected from both parties
- Target analytical reliability (accuracy, repeatability and transferability).
- Principles for validation.

### **General:**

- Common for all calibration material is that the reference-to-image identity is maintained for the individual object.

### **➤ Crop-type material:**

- Objects representing the crop-type for which a given calibration is developed.

- If the crop-type is wheat, for example, crop-type material shall represent both healthy wheat and wheat affected with relevant disorders.

**Class-type material of foreign objects:**

- Objects representing the foreign material for which a given calibration is developed, e.g. radishpods.
- Usually, the same foreign object material can be used for developing calibrations for several crop-types.
- Usually, lack of relevant biological material is not an issue.

➤ **Class-type material of damaged objects:**

- Kernels of a given crop-type affected by a particular damage.
- Typical examples encompass sprouted, broken or skinned, kernels etc. as opposed to healthy kernels from the same crop-type.
- Lack of relevant biological material can be a huge issue and depends on the whims of nature.

**Crop-type material:**

- At least 10,000 objects as a rough guideline.
- The amount will tend to rise further over time to encompass several harvest seasons and/or broader geographical diversity.

**Class-type material:**

- At least 2,000 objects as a rough guideline.
- Foreign object material from a single harvest season and limited geographical origin may well be sufficient.
- For damaged kernels the amount tend to rise further over time to encompass several seasons and/or broader geographical diversity.
- There is often an inverse relationship between the amount of calibration material and the time used to develop a calibration.

- Slope and validation samples are handled in the same way.
- They are bulk samples, meaning that a given result is correct if the bulk results from inspection and the EyeFoss are identical; thus they mimic normal commercial samples.
- In contrast, it remains unknown whether the exact same kernels are classified identically.
- By the nature of things the samples are scanned in bulk with the kernels facing the camera in a random manner.

## Validation Samples: Types of Samples

- The slope-set is used to convert the predicted output from the EyeFoss (count/count % or v/v %) to the commercial unit required.
- An additional purpose is to enable a slope- and intercept correction of the calibration to compensate for would-be model imperfections.
- Slope samples are not required for PoP studies.

### **Validation Samples:**

- The purpose of the validation-set is to provide a completely independent validation of the accuracy of the prediction model.

### **Transferability Samples:**

- The validation set may additionally be used to assess transferability.
- Alternatively, one can use a separate set made and quantified in the same manner as the validation set.

## Validation Samples: Number of Samples

- Typically a slope set (if required) comprises 15 samples and a validation set an additional 15 samples for a given crop-type.
- Each sample shall be ½ liter.
- To save labor the samples shall as far as possible combine all the classes to be sloped/validated.
- However, additional class-specific samples may be required.

- For each class the range shall slightly exceed the uppermost commercial grading limit expressed in the relevant commercial unit.
- The composition shall mimic but not exceed the range of biological variation in the calibration material.

- Normally, foreign object slope- and validation samples can be spiked by mixing pure fractions of the pure foreign object material with NotMaterial in proportions covering the range in question.
- Due to the nature of spiking it is not a problem covering the desired range of variation.
- After mixing the spiked samples are scanned but need not to be graded as the composition is already known.

- Spiking can usually not be used for classes representing kernel damages.
- Samples with damages must therefore represent un-manipulated samples as collected naturally.
- If it proves difficult to cover the upper concentration range of a class, the concentration can be increased by removing NotMaterial kernels from the sample.
- Grading must be done on each of the entire ½ liter sample to minimize the error associated with the reference determination.